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TOXICITY OF VARIOUS BENZENE DERIVATIVES TO INSECTS

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INTRODUCTION

The author in a previous paper (5)[1] pointed out the possibility of fumigating animals with nitrobenzene[2] to destroy their external parasites. In that work and in later experiments with nitrobenzene as many as 500 animals (cattle, sheep, hogs, chickens, dogs, cats, rats, and guinea pigs) have been fumigated, with only two cases of possible poisoning. One case was the fumigation of five chickens, which, through a misunderstanding of an assistant, were fumigated for 13 hours instead of 8, with the result that the chickens later died from paralysis of the central nervous system. The other instance was that of a young cat, which after one hour showed signs of uneasiness and was removed from the fumigation cage. As no symptoms of poisoning resulted in this case the cat may have been reacting to a strange environment rather than to the action of the poison.

Nevertheless, in view of the extreme toxicity of nitrobenzene as recorded in different works on toxicology, it was felt that it might be too poisonous for general use by inexperienced persons. For this reason a study of a series of benzene derivatives was undertaken with a view to determining their toxicity to insects; and from the result of this study it was hoped that one or more compounds might be found which would be quite toxic to insects while nontoxic to higher animals or plants. A study of the toxicity of the vapor of 28 benzene derivatives has been completed. A knowledge of the toxicity of the vapors of these compounds is valuable not alone for fumigation purposes but also as an

[1] Reference is made by number to "Literature cited," p. 380.

[2] In nomenclature the usage of American Chemical Society is followed.

index of their worth as contact sprays, since Shafer (6) and, more recently, McIndoo (4) have shown that most contact sprays kill by the action of their vapor rather than by the plugging of the spiracles.

COMPOUNDS USED IN THE EXPERIMENTS

From the hydrocarbon benzene C_6H_6 a great many compounds may be derived by replacement of one or more of the hydrogen atoms by certain other elements or groups of elements. These compounds are designated "mono," "di," "tri," etc., derivatives, depending on the number of hydrogens which are substituted. The following mono-substitution compounds have been tested in this study:

Benzonitrile, C_6H_5CN	Anilin, $C_6H_5NH_2$
Chlorbenzene, C_6H_5Cl	Benzaldehyde, C_6H_5CHO
Brombenzene, C_6H_5Br	Nitrobenzene, $C_6H_5NO_2$
Iodobenzene, C_6H_5I	Toluene, $C_6H_5CH_3$
Phenol, C_6H_5OH	

The following di-substitution products were employed:

Xylene, $C_6H_4(CH_3)_2$ (mixture of the three possible isomeres)	Ortho-chlorphenol, $C_6H_4OH\ Cl$
Para-dichlorbenzene, $C_6H_4Cl_2$	Ortho-nitrophenol, $C_6H_4OH\ NO_2$
Para-dibrombenzene, $C_6H_4Br_2$	Salicylic aldehyde, $C_6H_4O\ H\ CHO$

Besides these di-substitution compounds, several other derivatives were used, which may be considered di-substitution compounds of benzene or mono-substitutions of toluene. They were ortho- and para-bromtoluene ($C_6H_4CH_3Br$), ortho-, meta-, and para-cresol ($C_6H_4CH_3OH$), and ortho-nitrotoluene ($C_6H_4CH_3NO_2$). Inasmuch as different compounds are obtained by substitution in the methyl group of toluene rather than in the benzene ring of toluene, two such compounds were tested: Benzyl alcohol ($C_6H_5CH_2OH$) and benzoyl chlorid ($C_6H_5CO\ Cl$). Two derivatives of xylene were tried: Bromxylene ($C_6H_3(CH_3)_2Br$) and nitroxylene ($C_6H_3(CH_3)_2NO_2$).

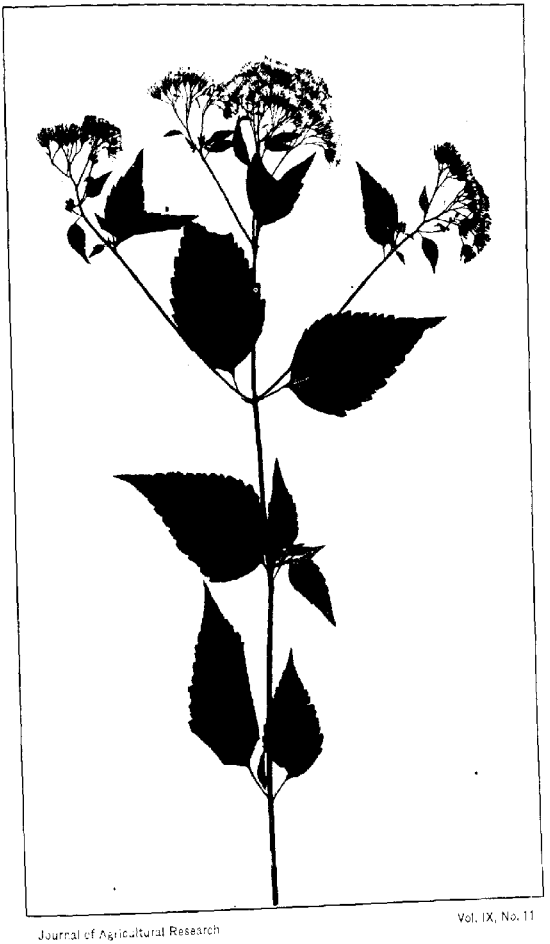
The xylene used in the experiments was a mixture of ortho-, meta-, and para-xylene; hence, the bromxylene and nitroxylene were also mixed compounds.

In this series is shown a wide range of compounds very different in chemical composition. A few others were tested but not included, owing to their slight volatility.

METHODS OF EXPERIMENTATION

One-liter Florence flasks of pyrex glass, closed with rubber stoppers, were used as fumigation chambers. As rubber was found to absorb the vapor of the chemicals, the stopper was coated with lead foil. Measured quantities of the compound to be tested were placed on a piece of filter paper cut just as small as possible, the paper was suspended from the

Eupatorium ageratoides PLATE 22



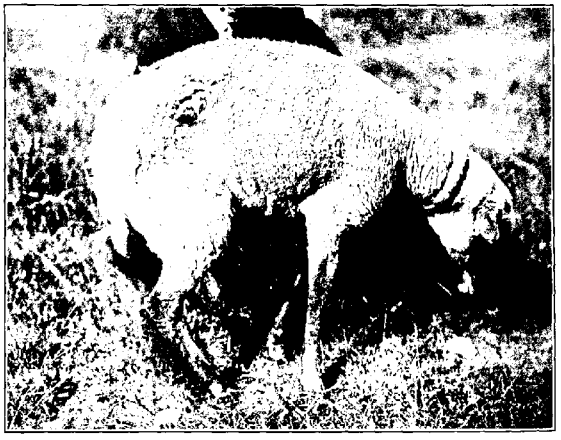


PLATE 23

A.—Ewe 161 in the characteristic standing posture when trembling is quite violent.

B.—The same animal with feet spread apart in an effort to stand when the tremors have become more acute.

PLATE 24

A.—At this stage of trembling the animal is unable to stand and is beginning to drop.

B.—Ewe 161 in the position to which she has dropped after a violent spasm of trembling.


A


B

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